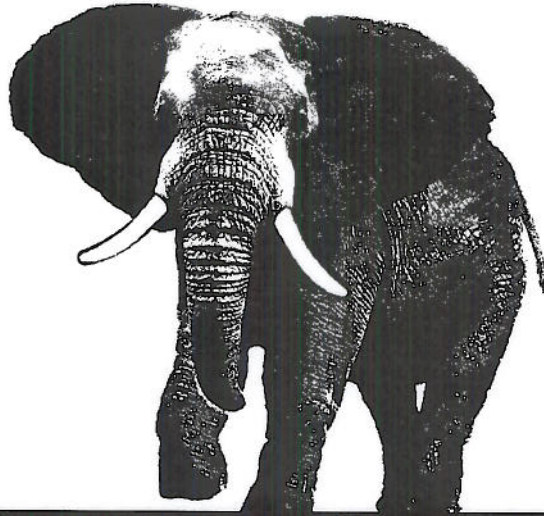


**INSTRUCTION MANUAL  
F-450-FS-SERVO  
450K COMPRESSION MACHINE - SERVO  
MN-F-450-FS-SERVO**



**FORNEY**

**1-800-367-6397**

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**SALES TERMS AND CONDITIONS**

THE TERMS BY WHICH FORNEY IS WILLING TO SELL MACHINERY OR OTHER ITEMS TO THE PURCHASER IDENTIFIED BELOW ARE EXPRESSLY LIMITED TO THE TERMS AND CONDITIONS CONTAINED HEREIN. NO OTHER TERMS AND CONDITIONS AND NO AGREEMENT OR UNDERSTANDING IN ANY WAY MODIFYING OR CHANGING THE TERMS AND CONDITIONS SET FORTH BELOW SHALL BE BINDING ON FORNEY, UNLESS SPECIFICALLY AGREED TO PURSUANT TO A WRITTEN INSTRUMENT SIGNED AND DELIVERED BY FORNEY'S PRESIDENT.

BY SIGNING BELOW, THE PURCHASER OF MACHINERY OR OTHER ITEMS OR SERVICES FROM FORNEY EXPRESSLY CONSENTS TO ALL OF THE TERMS AND CONDITIONS OF SALE SET FORTH HEREIN, NOTWITHSTANDING THE EXCHANGE OF ANY OTHER TERMS, OR ANY QUOTATION, PURCHASE ORDER OR ACKNOWLEDGEMENT FORM CONTAINING ADDITIONAL OR CONFLICTING TERMS AND CONDITIONS. ANY TERMS AND CONDITIONS OF SALE INCONSISTENT WITH THOSE SET FORTH HEREIN ARE SPECIFICALLY REJECTED. FORNEY'S PERFORMANCE OF ANY AGREEMENT WITH PURCHASER SHALL NOT BE CONSTRUED AS AN ACCEPTANCE OF ANY TERMS OR CONDITIONS OTHER THAN THOSE SET FORTH HEREIN.

PLEASE RETURN AN ORIGINAL SIGNED COPY OF THIS PAGE TO FORNEY INC WITHIN 30 DAYS, OTHERWISE, THE WARRANTY STATED HEREIN SHALL BE CONSIDERED VOID.

MODEL NUMBER: \_\_\_\_\_

SERIAL NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

By: \_\_\_\_\_  
Authorized Signatory of Purchaser



## F-450-FS-SERVO Instruction Manual

1. **Definitions:** As used in these Terms and Conditions, "Machinery" means any equipment, material, product, motor, article or item quoted or sold by or through Forney and/or listed on any document attached hereto or prepared in connection herewith. "Forney" means Forney, its affiliates and any entity for whom Forney acts as agent in connection with the sale of Machinery. "Purchaser" means all persons and entities acquiring Machinery from or through Forney.
2. **Offer and Acceptance:** These Terms and Conditions constitute an offer to sell Machinery and/or services which may be accepted only in accordance with these Terms and Conditions and without modification, addition, deletion or alteration. In the event that any correspondence, form documents (e.g., purchase order or acknowledgment forms) or sale terms submitted by or on behalf of Purchaser contain terms in addition to or different from those set forth herein, those additional or different terms are hereby rejected. Forney's willingness to contract with Purchaser is expressly conditioned on Purchaser's acceptance of the terms set forth below, which shall be deemed to constitute a counter-offer to any conflicting terms submitted by Purchaser.
3. **Duration of Offer:** Any quotations or offers extended by Forney are subject to immediate acceptance and prior sale. Forney reserves the right to withdraw, change or alter any quotation or offer submitted by it at any time prior to written acceptance.
4. **Delivery and Delay:** The shipping date or dates that may be set forth in any correspondence or document from Forney are approximate only and Forney shall not be liable for failure to deliver, delay in delivery or any other hindrance of performance occasioned by causes beyond Forney's control including, without limitation, strikes, labor shortages, labor stoppages, lockouts or other labor troubles, material shortages, fires, riots, floods, embargoes, war or other outbreak of hostilities, acts of God, inability to obtain shipping space, machinery breakdown, delays of carriers or suppliers, governmental acts and regulations and actions by Purchaser. In the event of such delay or hindrance, Forney shall be entitled to an extension of time commensurate with the delay or hindrance. Unless expressly agreed to the contrary by Forney in writing, all sales of Machinery by Forney are made "as is, where is" and shipped F.O.B. point of shipment; all risks of loss or damage in transit shall be borne exclusively by Purchaser; and all deliveries of Machinery to a common carrier or licensed trucker shall constitute delivery to Purchaser. Unless expressly agreed to the contrary by Forney in writing, Purchaser shall be solely and exclusively responsible for all costs and risks of loss or damage associated with the loading, shipment, transport, unloading, assembly and installation of all Machinery acquired from Forney. FORNEY SHALL NOT BE LIABLE FOR ANY DAMAGES ATTRIBUTABLE TO DELAYED SHIPMENT OR LATE DELIVERY INCLUDING, WITHOUT LIMITATION, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES RELATING THERETO.
5. **Cancellation by Forney:** Purchaser hereby acknowledges that Forney either has purchased or will purchase the Machinery from another party or parties. Accordingly, Forney shall have the full and unrestricted right to cancel any offer or quotation extended to Purchaser by notice to Purchaser if the Machinery has previously been sold or has been (or will be) withdrawn or otherwise disposed of by said party or parties. In the event of such cancellation, Purchaser shall have no claim or charge against Forney for the cancellation except for the return of any monies paid by Purchaser on account of the purchase price.
6. **Cancellation by Purchaser:** Upon cancellation by Purchaser of all or any part of a Purchase Order or other commitment to purchase from Forney, liquidated damages shall be payable by Purchaser as follows: Full cost to Forney of (i) all amounts expended or committed by Forney to acquire the Machinery ordered by Purchaser and to assemble the Machinery for shipment; (ii) all work in process relating to Purchaser's order; (iii) all equipment costs incurred by Forney in connection with Purchaser's order, including commitments made for the use of such equipment; (iv) all engineering, travel and rental costs incurred as a result of Purchaser's order; and (v) an amount equal to 10% of the aggregate of (i), (ii), (iii) and (iv) above for administrative overhead.



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7. **Transportation and Insurance Charges:** Except as may be specifically agreed to in writing by Forney, Forney shall not be responsible for freight, transportation, insurance, shipping, storage, handling, demurrage or similar charges. If such charges are by the terms of any quotation or offer extended by Forney included in the price of the Machinery, any increase in the applicable rates which becomes effective after the date of Forney's quotation or order shall be to the account of Purchaser.
8. **Taxes and Permits:** All sales, excise, gross receipts, value added or similar taxes, whether presently in force or hereafter enacted, shall be deemed extra charges and Purchaser agrees to pay the same at applicable rates. All licenses and permits, whether federal, state, local or those of a foreign government shall be obtained by Purchaser at Purchaser's expense. Purchaser shall be solely and exclusively responsible for all trade tariffs, import/export permits, charges and taxes, customs duties, stamp duties, registration fees, clearances and other consents arising from or connected with the purchase of any Machinery being acquired from Forney.
9. **Spare Parts:** Spare parts are not included in any quotation or offer of Forney unless expressly provided for in writing. At the request of Purchaser, spare parts shall be quoted separately, if available to Forney.
10. **Installment Delivery:** Forney reserves the right to deliver the Machinery in installments. Delay in the delivery of any installment shall not relieve Purchaser of its obligation to accept remaining deliveries of Machinery.
11. **Change Orders:** In the event that Purchaser desires to alter any Purchase Order previously submitted, Purchaser shall submit to Forney a written change order which shall become effective only upon written acceptance by an authorized officer of Forney.
12. **Modifications:** No modifications to these Terms and Conditions shall be effective unless agreed to in writing by an authorized officer of Forney. Any attempt to modify these Terms and Conditions by an instrument or form not executed by an authorized officer of Forney shall be ineffective.
13. **Governing Law:** The transaction between Forney and Purchaser contemplated by any quotation or Purchase Order shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania. All matters dealt with by any quotation or Purchase Order to which Forney is a party shall be governed by the Uniform Commercial Code, as in force in the Commonwealth of Pennsylvania on the effective date of the acceptance of the quotation or Purchase Order by Purchaser. In no event shall provisions of the United Nations Convention on Contracts for the International Sale of Goods apply to or govern the provisions of any agreement involving the sale of Machinery by Forney.
14. **Terms of Payment:** Unless Forney has specifically agreed to the contrary in writing, fifty (50) percent of the purchase price shall be paid by Purchaser immediately after Purchaser's acceptance of Forney's quotation or offer; and the remaining fifty (50) percent must be received by Forney prior to shipment of the Machinery. In the event that payment is not received when due, an interest charge of 1-1/2% per month will be charged on the overdue amount.
15. **Return Privilege:** Subject to the following provisions of this paragraph 15, any Machinery that is purchased from Forney's inventory "as is, where is" may be returned freight prepaid within 15 days of initial receipt for a refund of the purchase price if (i) the Machinery fails to conform to Forney's description in a respect material to its operation, and (ii) Forney has been informed in advance of the alleged nonconformity and has authorized the return in writing. Subject to paragraph 17 below, if applicable, the foregoing shall be the sole and exclusive remedy with respect to any issue or claim arising from any Machinery sold by Forney and shall not apply if the Machinery has been (i) damaged by Purchaser or subjected to misapplication, neglect or abnormal conditions of operation, (ii) damaged in transit, or (iii) sold directly from auctions, private users' plants, or any other sale or trade other than from Forney's stock. All returns shall be subject to a ten percent (20%) restocking charge.



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16. **Compliance with Safety Regulations:** In the event Forney performs installation or engineering services at the facility of Purchaser, Purchaser shall be solely and exclusively responsible for ensuring that working conditions at Purchaser's facility comply with all applicable federal, state and local safety rules and regulations, including but not limited to those promulgated under the Occupational Safety and Health Act of 1970 (collectively, the "Safety Regulations"). Purchaser shall be liable for all fines and penalties of whatsoever kind or nature in the event that said working conditions do not comply with such Safety Regulations. It is the duty of Purchaser to inspect all Machinery purchased from Forney, to provide proper safety devices to safeguard the operators from harm and to ensure compliance with all applicable Safety Regulations. Forney makes no representations or warranties that any Machinery sold by it complies with the Safety Regulations and specifically disclaims any liabilities arising from noncompliance.
17. a. **EX Series Testing Machines Limited Warranty:** With respect to EX Series Compression Testing Machines that have been manufactured by Forney only, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney warrants to Purchaser that for a period of two (2) years from the date of shipment, the Machinery will be substantially free of defects in materials and workmanship. In the event such Machinery is found to have a material defect in materials or workmanship, Forney shall remedy said defect by exercising one of the following three options, the choice of which shall be exclusively that of Forney. The options are: (a) Return of the Machinery to Forney for a refund of the purchase price paid by Purchaser; (b) Return of the Machinery to Forney for rebuilding by Forney, provided that Forney will rebuild the Machinery during regular working hours and will not be responsible for overtime or special rates; or (c) Replacement of the Machinery or components. Forney shall not be responsible for paying overtime or special rates to rebuild the Machinery. In the event that the option initially selected by Forney is not effective in remedying the defect, Forney retains the right to select either or both of the remaining options. Purchaser's damages for any breach by Forney of its obligations to remedy defects pursuant to this Paragraph 17 shall not exceed the cost of such remedial effort.
- b. **FX Series Testing Machines Limited Warranty:** With respect to FX Series Compression Testing Machines that have been manufactured by Forney only, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney warrants to Purchaser that for a period of three (3) years from the date of shipment, the Machinery, along with its hydraulic and digital readout components will be substantially free of defects in materials and workmanship. In the event such Machinery is found to have a material defect in materials or workmanship, Forney shall remedy said defect by exercising one of the following three options, the choice of which shall be exclusively that of Forney. The options are: (a) Return of the Machinery to Forney for a refund of the purchase price paid by Purchaser; (b) Return of the Machinery to Forney for rebuilding by Forney, provided that Forney will rebuild the Machinery during regular working hours and will not be responsible for overtime or special rates; or (c) Replacement of the Machinery or components. Forney shall not be responsible for paying overtime or special rates to rebuild the Machinery. In the event that the option initially selected by Forney is not effective in remedying the defect, Forney retains the right to select either or both of the remaining options. Purchaser's damages for any breach by Forney of its obligations to remedy defects pursuant to this Paragraph 17 shall not exceed the cost of such remedial effort.



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c. **Other Forney Manufactured Items Limited Warranty:** With respect to other items that have been manufactured by Forney only, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney warrants to Purchaser that for a period of (90) days from the date of shipment, the Machinery will be substantially free of defects in materials and workmanship. In the event such Machinery is found to have a material defect in materials or workmanship, Forney shall remedy said defect by exercising one of the following three options, the choice of which shall be exclusively that of Forney. The options are: (a) Return of the Machinery to Forney for a refund of the purchase price paid by Purchaser; (b) Return of the Machinery to Forney for rebuilding by Forney, provided that Forney will rebuild the Machinery during regular working hours and will not be responsible for overtime or special rates; or (c) Replacement of the Machinery. Forney shall not be responsible for paying overtime or special rates to rebuild the Machinery. In the event that the option initially selected by Forney is not effective in remedying the defect, Forney retains the right to select either or both of the remaining options. Purchaser's damages for any breach by Forney of its obligations to remedy defects pursuant to this Paragraph 17 shall not exceed the cost of such remedial effort.

d. **Items not manufactured by Forney Limited Warranty:** With respect to items that have not been manufactured by Forney, and not with respect to any other Machinery quoted or sold by Forney or its affiliates, Forney will pass on to the customer the benefit of any warranty Forney received from the original equipment manufacturer.

In order to obligate Forney under this Limited Warranty, Purchaser must notify Forney in writing within ten (10) days of the appearance of the defect, provide full details concerning the defect, and discontinue use of the Machinery. Upon receipt of this information, Forney will provide service instructions or shipping instructions. If shipping instructions are provided by Forney, Purchaser shall send the Machinery in accordance with those instructions and with freight charges prepaid by Purchaser. If Forney determines that repairs are warranted under the terms of this Limited Warranty because of defects, Forney will provide repair services at its place of business and the cost of such repair services and return freight charges will be paid by Forney; provided, however, that Forney may instead refund the purchase price in lieu of making such repairs. If Forney determines that the alleged defects are not covered by this Limited Warranty, the cost of its repair services and return freight charges will be paid by Purchaser. This Limited Warranty shall not apply if the Machinery has been assembled, installed, used, altered or handled in a manner contrary to any written instructions provided with the Machinery or if the Machinery has otherwise been subjected to misuse, neglect or abnormal conditions of operation.

18. **Machine Safety and Indemnification:** By accepting a quotation or "Offer to Sell" from Forney, Purchaser acknowledges and agrees that Forney has made no representations or warranties concerning the safety of the Machinery being sold, either on its own behalf or for anyone possessing an interest in the Machinery. Purchaser further acknowledges and agrees that Machinery sold by Forney may not include necessary safety equipment to permit safe operation or to comply with local, state, Federal, industry and/or other applicable Safety Standards or requirements. Before placing the Machinery in use, Purchaser agrees to utilize such safety equipment and give operators such instructions and/or warnings as may be necessary to permit safe operation and to comply with all local, state, federal, industry and/or other applicable Safety Standards, requirements and regulations. Purchaser further agrees to indemnify and hold Forney harmless from and against any and all claims and liabilities which may be incurred by Forney, including any and all costs and attorney fees, based in whole or in part on the failure to comply with applicable Safety Standards and/or the failure to provide safety equipment, instructions and/or warnings necessary to operate the Machinery safely.



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19. **Warranties and Remedies Exclusive; Further Warranties and Remedies Disclaimed:** EXCEPT FOR THE LIMITED WARRANTY PROVIDED PURSUANT TO PARAGRAPH 17 ABOVE, FORNEY MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, WITH RESPECT TO THE CONDITION, PERFORMANCE OR SHIPMENT OF ANY MACHINERY SOLD BY IT OR ANY COMPONENTS THEREOF, WHETHER OR NOT THE MACHINERY OR COMPONENTS HAVE BEEN REBUILT, ENGINEERED OR DESIGNED IN WHOLE OR IN PART BY FORNEY OR ANY AFFILIATE OF FORNEY. FORNEY SPECIFICALLY DISCLAIMS, AND PURCHASER HEREBY WAIVES, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. It is specifically understood and agreed that except to the extent provided in paragraph 17 above, Forney shall have no liability, whether claimed in contract, equity, tort (including negligence) or otherwise, for or resulting from defaults in workmanship or materials or failure of performance of any Machinery sold by it.
20. **Limitation of Liability:** Forney shall not be liable for any special, incidental, indirect or consequential damages, or for any equivalent proximate damages, arising out of or connected with any Machinery sold or services provided by it, regardless of whether any such liability shall be claimed in contract, equity, tort (including negligence) or otherwise. By way of example of the foregoing limitation of liability, but without limiting in any manner its scope or application, Forney shall not be liable for all or any part of any of the following, no matter how claimed, computed or characterized:
- (a) loss of profits or revenue, loss of return on investment, cost of capital, loss of operating time or production, loss or reduction of use or value of any facilities or replacement products, or increased costs of operation or maintenance; (b) damages incurred in the unloading, assembly or installation of the Machinery; (c) damages relating to the operation of the Machinery or to any products manufactured in whole or in part with the use of the Machinery; or (d) interruption of business. The limitation of liability contained in this Paragraph 20 shall be effective without regard to Forney's performance or failure or delay of performance under any other terms and conditions, including those contained in Paragraph 17 hereof.
21. **Indemnification:** In consideration of Forney's agreeing to sell items of Machinery to Purchaser and/or to provide services to Purchaser, and intending to be legally bound hereby, Purchaser covenants and agrees to indemnify and hold Forney and its affiliates harmless from and against any and all claims, demands, actions, causes of action, damages, costs and expenses, including attorney's fees, which arise directly or indirectly from Forney's sale of Machinery and/or services to Purchaser. Without limitation as to the foregoing, Purchaser's indemnity shall encompass and include any and all incidental, special, direct, indirect and consequential damages incurred by it including, without limitation, lost profits, damage to reputation, injury to persons (including death) and damage to property.
22. **Dispute Resolution and Venue:** The sole and exclusive means of resolving any dispute which may arise from Forney's sale of Machinery and/or services to Purchaser shall be the submission of such dispute to arbitration under the auspices of the American Arbitration Association in Pittsburgh, Pennsylvania.





### A) Inspection

Upon receiving shipment of your new machine, before uncrating or unpacking, inspect the crates/boxes for signs of freight/handling damage.

If container shows visible signs of damage, contact the freight carrier for possible damage claim.

### B) Uncrating

To properly uncrate your new Forney Machine, just follow these eight (8) steps:

- 1) Remove metal straps around crate/box with suitable cutters (shears)
- 2) Remove top of box/crate
- 3) Remove any wooden braces on the top and sides of the machine
- 4) If crated, remove the sides of the crate, if boxed, remove the entire box
- 5) If accessories are included, unband/unbrace and remove
- 6) Cut all remaining bands, remove all wooden braces on pallet
- 7) Machine can now be removed from pallet.
- 8) Locate the packing list and check parts and units against the packing list to make sure the shipment is complete.





### **C) Lifting & Moving the Machine**

The machine is shipped in the vertical position. Lifting should be performed by placing an eye bolt in the top of the machine. This eye bolt is the only recommended lifting location on the machine. Use an overhead crane or power winch, with a suitable weight capacity to transport your machine.

The console may be moved with an overhead crane, or fork lift. The machine may also be moved by overhead crane, but great care must be exercised so as not to damage the machine from accidental slipping, tipping over, or mishandling.



#### **D) Machine Location**

It is recommended that the machine be located in an area where the atmosphere is free from acidic or contaminating fumes, which could possibly accelerate corrosion to, machined surfaces or electrical contacts.

Machines equipped with electronic load monitors should be located in a heated lab type environment where humidity or condensation is not a problem.

A dedicated electric outlet is recommended to help insure that proper electric is provided to the unit.

When facing the front of the machine, the console should be located to the right of the frame.



## E) Cleaning

To protect your new testing machine during shipping and through extended periods of exposure to the elements; a rust-preventative has been applied to the external surfaces of the machine.

After positioning/installing your machine, and prior to making the hydraulic connections, the rust inhibitor should be removed.

- 1) Dampen a clean, dry cloth with a suitable, non-film producing solvent.  
i.e. Stoddard Solvent (use rubber gloves)

NOTE: Do not soak cloth or rub painted surfaces vigorously, as the solvent may attack the paint.

- 2) Gently wipe the surfaces until tackiness is gone, gently wipe with a dry cloth.

To reduce particle contamination after testing, a dry wipe down should be done. This will greatly reduce the possibility of contaminants entering the piston cylinder area.

Solvent need not be used unless an accumulation of particles is present, and otherwise hard to remove.

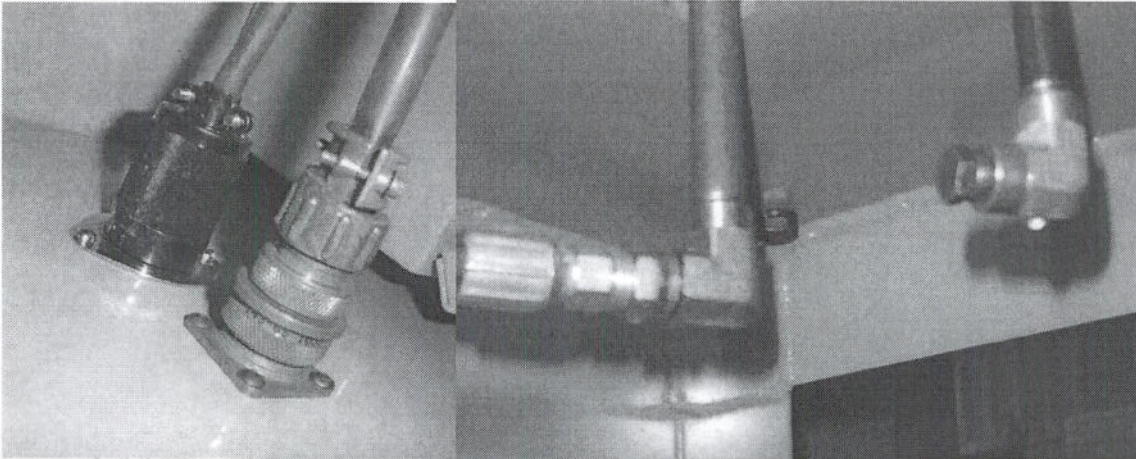


## F) Connections & Set-up

To complete machine installation perform the following tasks:

- 1) Connect the hydraulic line from the console to the frame connection underneath the cylinder. Only one line is connected (leave the plug in the extra aux line).
- 2) Install the electric connections from the Frame to the control box for the encoder and limit switch.
- 3) Once all hydraulic connections have been made, check fluid in reservoir (add if needed).
- 4) Have a certified electrician connect 220VAC/3Phase power to the Motor Starter Junction Box on the bottom-right portion when viewing from the front of the console. Be sure that the motor is turning the proper direction (check arrow on motor). If needed, reverse two of the wires and check motor rotation again. Positive pump flow will only occur if the motor is turning the proper direction.

Note: Machine is shipped with hydraulic oil. Check level to make sure none was lost during shipping. Full is top of the sight gauge (21 gallons). DO NOT START motor/pump unit before oil is added to the system if needed, ISO 46 hydraulic oil.





## H) Calibration

In accordance with ASTM E-4, testing machines are calibrated annually. All Forney testing machines are calibrated at the factory following the guidelines of ASTM E-4.

During the calibration, all safety devices and accuracy adjustments are pre-set to give maximum performance and safe operation.

Even though the machines are completely serviced and calibrated at the factory, ASTM requires that machines be calibrated after installation to obtain the highest degree of accuracy possible.

**ON-SITE CALIBRATION** – A complete on-site calibration service is available from Forney through our Authorized Regional Service Representatives. Forney recommends the use of their Authorized Factory-Trained Service Representatives for all calibration services. These Representatives are trained to perform ASTM E-4 calibration procedures, with instruments conforming to ASTM E-74. They are also qualified to perform various preventative maintenance procedures. Procedures, which combined with annual calibration, will greatly reduce the possibility of down-time of your machine.



## MAINTENANCE INSTRUCTIONS

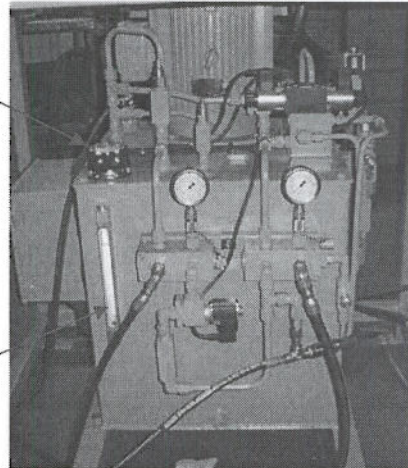
The following operations should be performed with the power off. The piston should also be retracted to effectively determine fluid level. Open the side or rear doors of the console to gain access to the pump/motor assembly and filter.

### Checking & maintaining the oil level

1. After locating the pump & motor assembly, find the sight glass mounted on the left side of the reservoir.
2. Check the oil level in the reservoir by viewing the sight glass to make sure the fluid can be seen in the upper sight glass. Full is a reading to the top of the sight gauge when fully retracted.
3. When it is necessary to add oil to the reservoir, remove the cap and fill the reservoir to the proper level with ISO 46 Hydraulic Oil. (Do Not Overfill). The total system capacity is 21 gallons.

Filler Cap

Sight Glass



### Keeping this unit clean, and the oil free of dirt will increase the life of the pump & valves

The reservoir should be drained and replenished with clean oil at least once a year or more often if possible. The frequency of the oil change will depend on the general working conditions, hours of use, and the overall cleanliness and care given to the pump & valves.



Filter Housing/Element

Drain Plug

Filter Indicator

### Replacing the oil filter

1. The piston should be fully retracted and the hydraulic motor should be off.
2. Remove drain plug from oil filter cover and drain oil from filter into a bucket and discard of properly.
3. Remove filter base, by unscrewing, and pull filter element out and discard of properly. The inner core is re-usable (only replace outer filter element)
4. Installation is reverse of removal.
5. Refer to bleeding air from the system below to re-start machine. Afterwards, re-check oil level and top off properly.



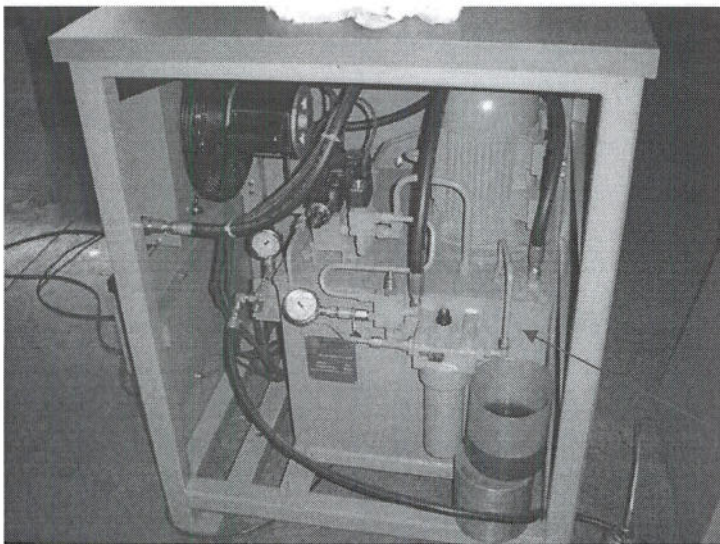


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### Bleeding air from the system

Upon initial start up, air can accumulate within the hydraulic system. The trapped air can cause the system to not advance at all, advance slowly, or surge and make the motor become noisy. To remove the trapped air, try the following steps.

Unscrew the high pressure line before the oil filter and bump the motor (turn it on and then back off in about a second). Make sure you set up a container to catch the oil. Do this repeatedly until the pump primes and you start to get oil flowing out. Another method is to remove the line completely and use a pressurized oil can to inject some fluid down the line into the pump, priming the pump. Bump the motor again, until fluid comes out. Reattach the line, and run until you see air free fluid flowing out, and then reattach the line completely.



High Pressure Line

### Oil Cooler Air Filter

The machine is equipped with an industrial heat exchanger to cool the oil on the right side of the console. **This area must be kept clean and free of objects to allow air to flow in the system!** Once a year (or as needed in a dirty environment) remove the air filter screen and blow it out with compressed air to remove dust buildup and re-install in machine.



## A) MACHINE CONTROL SYSTEM

### **1 Overview**

There are two major components that make up the control system of this machine: The Allen-Bradley PLC and the laptop running Rockwell Automation's RSView32 HMI software. The PLC actually controls the machine. The HMI allows you to set up and run the machine, as well as view and analyze important test data.

This portion of the manual is dedicated almost solely to the operation of the HMI. You will access most machine controls through the HMI. The only functions not accessed via the HMI are the few basic buttons located on the control panel(s). These buttons are for system power, Emergency-Stop, hydraulic pump start, jog, retract, etc. They will also be covered where necessary.

### **2 Communication**

The HMI communicates with the PLC via an Ethernet cable using the TCP/IP protocol. The PLC is configured with an IP address of 192.168.0.6. It has a subnet mask of 255.255.255.0. This means that any device needing to communicate with the PLC must have an IP address of 192.168.0.x, where "x" is a number between 0 and 256, but not 6 (since the PLC is already assigned this address).

The HMI laptop is assigned IP address 192.168.0.2. This address can be changed according to the constraints described above, but it must have a static IP address.

### **3 Startup**

Since there are two major components (the PLC and HMI) that must interact with each other, proper machine power-up is important.

#### **3.1 Servo Control System (PLC)**

When power is supplied to the machine, the first item that should be turned on is the Servo-Control System (which includes the PLC). Push the "Servo Power" button on the control panel. When power is on, the button will light up, and stay in the "down" position.

Once power is applied, the PLC and its I/O cards will run a series of diagnostic checks. During this time, the "OK" lights of these devices will blink. These checks take about 30 seconds to a minute. When the diagnostic checks are complete, the PLC is ready.

To turn the power off, simply press the "Servo Power" button again. The button light will go out, and the button will rise to its "up" position.

#### **3.2 HMI**

Once PLC power has been applied, you can now power up the HMI. The reason for powering up the PLC first is that the HMI will attempt to communicate with the PLC immediately upon starting. If the PLC does not have power, the HMI will time



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out without establishing communication. If this happens, the HMI will need to be shut down and restarted.

### 3.3 **Control Panel**

The control panel contains some traditional switches, buttons, and lights for the most basic operator interface. The components are described below:

**Emergency Stop (E-Stop)** button – This button is a safety feature of the machine. If something unexpected happens while the machine is running, the **E-Stop** button can be pressed. Pressing this button removes all output power from the system. This means that the hydraulic pump motor will stop, and all controls and solenoids will return to their default positions. This button should be used in emergency situations to kill hydraulic power on the machine. The button “locks” in the down position after being pressed.

After the emergency condition has been addressed, the **E-Stop** button can be raised, and the machine can be restarted.

This button is redundantly located on both the HMI screen and on the LT frame.

**Servo Power** button – As explained above, this button applies power to the PLC and its I/O cards. The button lights when power is on.

**Hydraulic Start** and **Stop** buttons – These two buttons are used to start and stop the hydraulic pump motor. Pressing **Start** will turn the motor on, and pressing **Stop** will turn the motor off. The motor will only start when: **Servo Power** is on and **E-Stop** is reset.

**Cycle Start** button – This button is a non-emergency “stop” button. The hydraulic pump motor can run with this button in either position, but no machine movement is possible until the button is in the “raised” position. When the button is pressed, machine movement stops, and the button lights.

**Control** switch – This switch has two positions: **Manual** and **Servo**. **Manual** position is used for manually jogging the machine, and for selecting calibration mode. **Servo** is used for jogging/retracting the machine while holding position and running tests.

### 4 **Main Screen**

When the HMI laptop powers up, and the HMI software starts, the “Main Screen” is displayed. Basically, this is the login screen. Click the “Login” button, and a window pops up for you to enter a username and password.

Different user logins have different levels of access. Currently, there are only two levels of access: Operator and Administrator (Engineer). There are three login names for these levels. The login name for Operator access is “oper.” There are two logins for Administrator access: “admin” and “engineer.”



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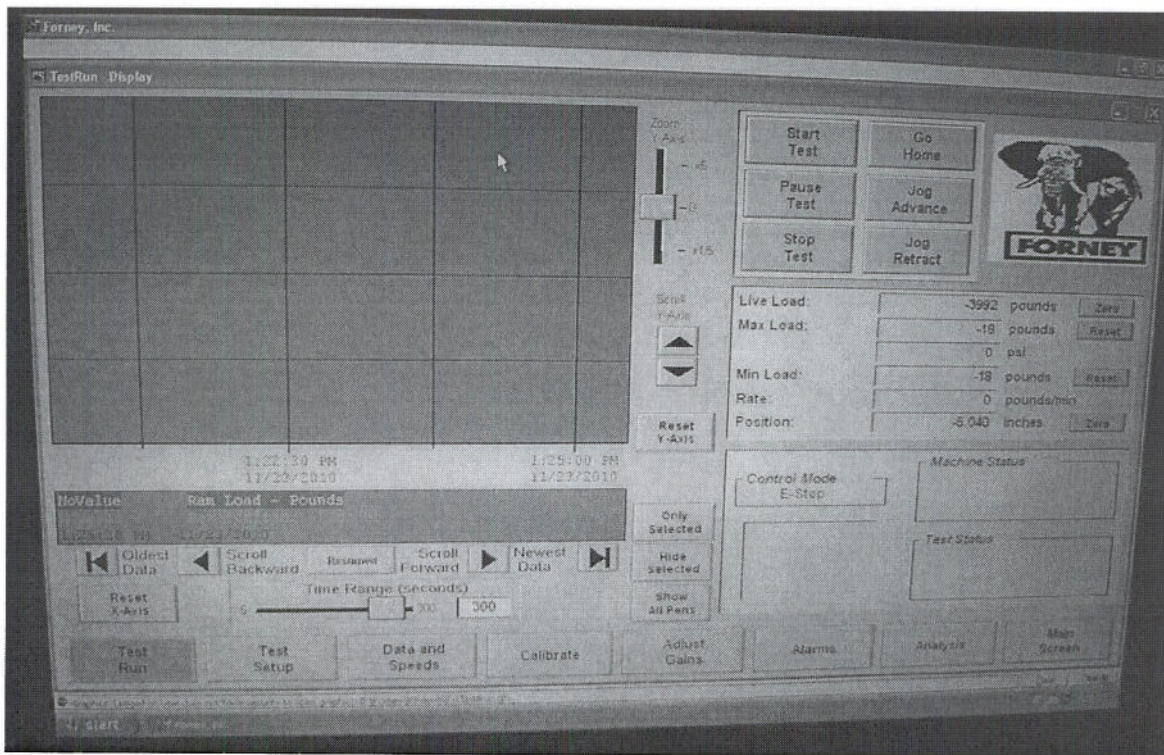
Once you have entered your username and password, click the “OK” button to login. If successful, the “Test Run” screen will be displayed.

To return to the “Main Screen” at any time, simply click the “Main Screen” button on any page. If you want to login as a different user, you can simply click the “Login” button, and enter the desired username and password.

To quit the HMI software, click the “Quit” button.

### 5 Test Run Screen

The “Test Run” screen provides all machine controls, and displays all real-time data from the machine. The following sections describe the various features of this screen.



#### 5.1 **Buttons**

On the top-right side of the screen are the buttons required to control tests. Here is a description of each button:

**Start Test** – When a test is ready, press this button to start the test. When a test is running, this button will be green. When a test is paused, this button will remain green. During preload, this button will blink green.

**Pause Test** – During preload or a running test, the **Pause Test** button can hold the current load (or position, in preload). When you are ready to resume the test, press the **Start Test** button. When a test is paused, this button will be red.



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**Stop Test** – During preload, a running test, or while paused, the **Stop Test** button can be pressed to stop the test. The test will need to be restarted as though it had not been run at all. Stopping the test will not retract the test, press the **Go Home** button to return (retract) to the start of the test position.

On the bottom-right of the screen are some manual control buttons:

**Go Home** – This button is used when the machine is in Auto (servo) mode. Pressing this button will send the main ram to its “zero” position set before starting a test.

**Jog Advance** – This allows the user to jog advance the main ram. The ram only moves while the button is being pressed. Therefore, the button must be held in while the ram is moving. Releasing the button will stop the ram.

**Jog Retract** – This allows the user to jog retract the main ram when in Servo mode. The ram only moves while the button is being pressed. Therefore, the button must be held in while the ram is moving. Releasing the button will stop the ram.

### 5.2 Display Fields

The “Test Run” screen displays machine status, test information, and control system information. The information displayed is explained below:

**Live Load** – This is the current load measured at the machine’s main ram. This is a calculated value based on the hydraulic pressure at the ram, and the diameter of the ram. This value can be reset at any time (press the **Zero** button next to the **Live Load** value), other than when a test is running. Resetting the value allows for compensation for materials placed on the ram that do not exert force on the test specimen.

**Max Load** – This is the maximum load encountered by the main ram since it was last reset. This value is reset at the beginning of every test. It can also be reset by pressing the **Reset** button next to the **Max Load** value.

**Min Load** – This value is useful in cyclic or segmented tests. It displays the minimum load encountered each time the test reduces the load. It can also be reset manually by pressing the **Reset** button next to the **Min Load** value.

**Rate** – This is a display of the current ramp rate during a test. During a “dwell” period, the rate will display as “zero.”

**Position** – The current main ram position as measured by the encoder. The position can be reset manually at any time except when a test is running by pressing the **Zero** button next to the **Position** display. A **Position** of “zero” is considered the “Home” position.



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**Control Mode** – Displays the current control status of the machine. It displays one of three values: “E-Stop,” “Manual,” or “Auto.” “E-Stop” is displayed when either one of the **E-Stop** buttons have been pressed, and is still in its “down” position, or when the limit switch has reached its maximum travel. “Manual” or “Auto” is displayed depending on the position of the **Control** switch. “Auto” indicates that the **Control** switch is in the “Servo” position.

**Machine Status** – This field has many possible display values:

“Machine NOT Calibrated” – There are no calibration values in the system, or they are invalid.

“No ‘Test Type’ Selected” – A “test type” of monotonic, cyclic, or segmented must be selected using the “Test Setup” screen.

“Ready – xxx Test Selected” – The machine is ready to run a test. One of the three test types has been selected, and will be displayed in place of “xxx” (i.e., “xxx” = “Monotonic,” “Cyclic,” or “Segmented”).

**Test Status** – This field has many possible display values:

“Preloading” – This is displayed during preloading. The **Start Test** button will also blink green when preloading.

“xxx Test Running” – The selected test is now running (i.e., “xxx” = “Monotonic,” “Cyclic,” or “Segmented”).

“Test Paused... Press ‘Start Test’ to Continue” – The current test has been paused. The **Start Test** button will be green, and the **Pause Test** button will be red.

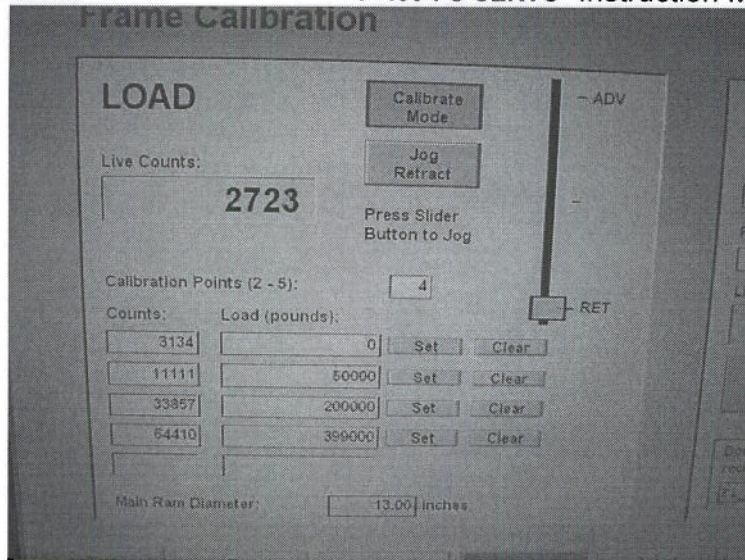
**Cycle** – For a cyclic test, this field displays a count of the cycles that have run. The format is “x of y,” where x is the current cycle count, and y is the total number of cycles to be run.

### 5.3 Trend Display

The trend display is always active. It displays real-time values of main ram load and position. The trend is auto-scaling, and will scale each signal according to its “best-fit.” The operator can also pause and zoom to get a different look at the data.

## 6 Calibration

Before the machine can be run, it must be properly calibrated. The calibration procedure is similar to comparable machines, and will be described below. Calibration is completed on the “Calibration” screen. Please note, the user must be logged in as ‘admin’ to calibrate the machine.



The general process is to assign analog transducer count values to known load values. Choose between 2 and 5 points with the first always being zero. An operator may go through and enter your load values before starting. Above, four points are being used.

The **Calibration Slider**, **Calibrate Mode** button, and **Set** buttons are all used during calibration. The Calibration Slider (ADV & RET) is used to open or close the servo valve during calibration using one of two modes below.

The **Cycle Start** button can be used to select one of two calibration modes (machine should be in manual position for calibration):

1. When **Cycle Start** is active (down and lit up), the calibration slider is always active and the calibrator is free to adjust the servo valve to a convenient flow and keep the valve flowing after releasing the slider. This allows the user to move the mouse over the **Set** button and press it at the precise time the calibration load value is reached. This will automatically store the count value at that moment. Pressing **Calibrate Mode** will toggle between calibration mode (Green) and pause the servo valve (Red).
2. When **Cycle Start** is not active (up and not lit up), the calibration slider must be held to activate the servo valve. Pressing **Calibrate Mode** will toggle between the press and hold to move servo slider (Green) and full advance when you press the slider (Red). This mode can be useful for getting calibration points to enter manually, but most users will almost always use option 1 above to calibrate.

The required number of calibration points must contain calibration data, and each successive value must be greater than its predecessor for the calibration to be considered valid. The number of points you use is determined by your calibration requirements.



When entering data into the HMI fields, you must hit the “Enter” button on the computer for the data to be sent to the PLC. If you simply type a value, then click on the next field without hitting “Enter,” the value will not be sent to the PLC. In addition, most data-entry screens have a “Send Settings To Controller” button. This button can be used in lieu of hitting the “Enter” button. It will send all settings on the screen to the PLC.

### 6.1 *Position*

Position calibration is the easiest procedure. There are no measurements to be made. The calibration parameters are provided by the encoder manufacturer.

Here is the procedure:

1. Type the encoder’s range in the **Range** field. This value is supplied by the encoder manufacturer, and is typically printed on the device itself.
2. Press “Enter” on your keyboard to send the value to the PLC.
3. Type the encoder’s pulses per inch value in the in the **Pulses/Inch** field. This value is supplied by the encoder manufacturer, and is typically printed on the device itself.
4. Press “Enter” on your keyboard to send the value to the PLC.

The position regulator is now calibrated. If you replace the encoder, you will need to enter the values from the new device for accurate measurement.

### 6.2 *Load*

Load calibration is more complicated than position calibration. You will need to install a load cell into the machine to measure actual load while running the machine.

Here is the procedure:

1. Enter the desired number of calibration points into the **Calibration Points (2–5)** field. This can be any value from two (2) to five (5), and is determined by your calibration requirements.
2. Press “Enter” on your keyboard to send the calibration points value to the PLC.
3. At the bottom of the load calibration portion of the screen, enter the **Main Ram Diameter**. This value should already be entered (13”). The load value is calculated by multiplying the hydraulic pressure at the main ram by the surface area of the ram.
4. Press “Enter” on your keyboard to send the **Main Ram Diameter** value to the PLC.
5. Start the hydraulic pump motor by pressing the **Start** button on the control panel.
6. Enter the target load values for calibration. To save time when calibrating, enter your target load values into the **Load (pounds)** fields.
7. Press “Enter” on your keyboard to send each **Load** value to the PLC.
8. Use the **Jog Slider** to achieve the desired load at the calibration point. To increase the speed of advance, slide the button up (toward “ADV”). To





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decrease the speed of the jog, slide the button down (toward "RET") while holding it pressed.

9. When you achieve the desired load, click on the **Set** button next to the load value you have achieved. You will see a counts value appear in the **Counts** field. Alternatively, you can enter the count value desired in the field and press enter.
10. Use the **Jog Slider** button, and advance to the next load value.
11. Click the **Set** button next to the load value you achieve for each of your calibration points.

When you have clicked **Set** for all calibration points, you are done. You can press the "Send Settings To Controller" button to verify that all settings have been sent to the PLC.

You should save your calibration data to a file. To do this, double-click the filename under the text, "Double-click to choose a recipe file to upload or save." A window will open allowing you to choose a name for your calibration file. You should give this file a unique name that identifies the calibration, and that you can remember if you need to restore these values.

Once the calibration is complete, you can return to the "Test Run" screen by clicking the **Test Run** button at the bottom of the screen.

### **7 Adjust Gains**

Under normal conditions, you should never need to adjust the gains! The machine has been tuned at the factory. However, if that need should ever arise, here are some notes to be followed.

If you change a gain value, you must hit "Enter" on you keyboard to send the value to the PLC. You can also click the "Send Settings To Controller" button to verify that all values have been sent to the PLC.

### **8 Data and Speeds Screen**

After calibration, but before you make any other movements with the machine, you should check the "Data and Speeds" screen. This screen allows you to set and/or change many machine parameters. Each of these parameters is explained below.

#### **8.1 Specimen Data**

In order to properly calculate various test parameters, specimen data needs to be entered per the proper test type selected: **Cylinder, Cube, Rebar, or Other**.



Specimen Data

**Cylinder**

Diameter:

Length:

**Cube/Rectangle**

Width:

Depth:

Length:

**Rebar**

Diameter:

**Other**

Area:

Length:

The **Specimen Break** field is used to determine when the specimen is to be considered broken. The maximum load applied to the specimen is constantly measured. **Specimen Break** is entered as a percentage of this maximum load. When the specimen breaks, the load will quickly drop. When the load drops to a value equal to or less than this percentage of maximum, the specimen is considered to be broken, and the test ends.

When any value is typed into a field, press "Enter" on your keyboard to send the value to the PLC.

Ramp Rate:  pounds/minute

Specimen Break:  % of peak load

### 8.2 Preload

The **Preload Amount** is the load at which the control system switches from position control to pressure (load) control. It is entered as a value in pounds.



The **Preload Rate** is the speed at which the ram moves in preload. It is entered as a value of inches per minute.

When any value is typed into a field, press “Enter” on your keyboard to send the value to the PLC.

### 8.3 Jog

**Jog Advance Speed**, and **Jog Retract Speed** control the same function, just in opposite directions. These values determine the speed of the manual jogs. They are entered as a value of inches per minute.

The **Go Home Rate** is similar to the jog speeds. It determines the rate at which the main ram moves to home (zero) position at the end of the test.

When any value is typed into a field, press “Enter” on your keyboard to send the value to the PLC.

### 8.4 End of Test

The **End of Test** button determines what the machine does at the end of the test. When pressed, the button is green, and the button text says, “Go Home.” This means that the main ram will move to its home (zero) position at the end of the test.

When the button is released, it is gray, and the button text says, “Stop.” This means that the main ram will simply stop where it is at the end of the test.

### 8.5 Data Logging

This section of the “Data and Speeds” screen controls the data-logging feature of the machine. There are three data-logging segments. This allows for a slower logging rate during non-essential portions of the test, and a faster logging rate when necessary.

In addition, **Logging Threshold** specifies the load at which data logging will begin. This prevents needless data from being logged at the beginning of a test. When the load reaches the **Logging Threshold**, logging begins.

**Logging Rate** specifies how many data samples will be logged each minute. This can be any number from zero (0) to 2000. A value of zero (0) can be used to delay or pause logging for the duration specified.

**Segment Duration** specifies the length of time to collect data at the specified **Logging Rate**. The **Segment Duration** is entered as a value in minutes. If a value of zero (0) is entered, the specified **Logging Rate** will be utilized for the remaining duration of the test. For example, if “Segment 1” has a rate of 100 and a duration of 1, and “Segment 2” has a rate of 1000 and a duration of 0; the system will log 100 values for the first minute, then log 1000 values per minute until the end of the test.



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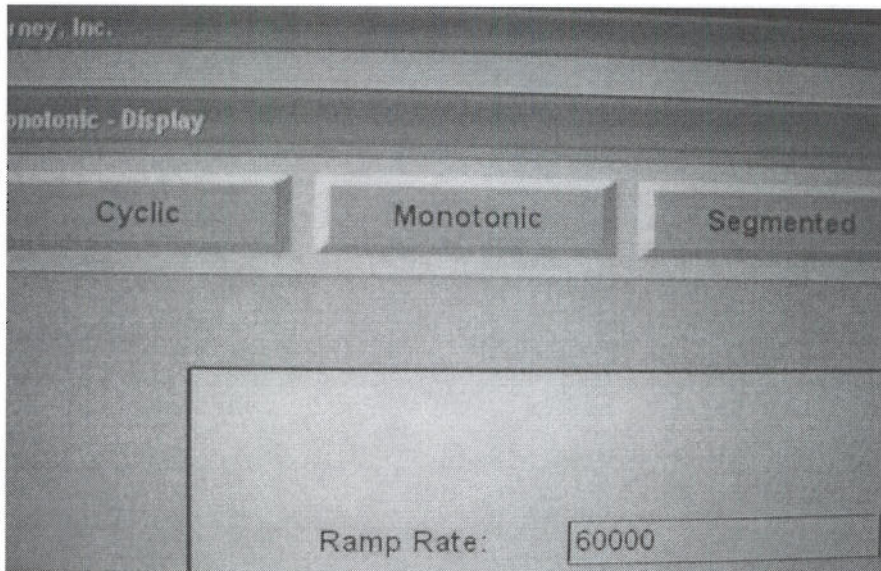
When any value is typed into a field, press “Enter” on your keyboard to send the value to the PLC.

Once you have entered values in all fields, you can press the “Send Settings To Controller” button to verify that all settings have been sent to the PLC.

You can also save your settings for future use. To do this, double-click the filename under the text, “Double-click to choose a recipe file to upload or save.” A window will open allowing you to choose a name for your “Data and Speeds” file. You should give this file a unique name that you can remember if you want to restore these values (e.g., add the date to the end of the filename). All recipe files are stored in the same location. If you save this file with the same name as another file, you will overwrite the other file. You can create several different recipes for different situations, and load the desired recipe when needed.

### **9 Test Setup Screen**

The “Test Setup” screen is where you specify the type of test to run. When you first start up the system, no test type will be selected. To select a test type, click on one of the test type buttons (***Monotonic***, ***Cyclic***, or ***Segmented***). When you click on a test type, its button will be green, and the other two buttons will be gray. You can select a new test type any time except when a test is running.



Once you select a test type, its corresponding setup screen will be displayed. Each test type will be explained below.

#### **9.1 Monotonic**

A monotonic test is a simple test where the ram increases load on the test specimen at the desired rate until the specimen breaks, the user stops the test, or the capacity of the machine is reached.

The only setting for this test is ***Ramp Rate***. It is entered as a value of pounds per minute. When you type the value into the ***Ramp Rate*** field, press “Enter” on your



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keyboard to send the value to the PLC. You can also press the “Send Setting To Controller” button to verify that the value has been sent to the PLC.

You can also save your setting for future use. To do this, double-click the filename under the text, “Double-click to choose a recipe file to upload or save.” A window will open allowing you to choose a name for your “Monotonic Test” file. You should give this file a unique name that you can remember if you want to restore the value (e.g., add the date to the end of the filename). All recipe files are stored in the same location. If you save this file with the same name as another file, you will overwrite the other file. You can create several different recipes for different situations, and load the desired recipe when needed.

### 9.2 *Cyclic*

A cyclic test allows the machine to repetitively apply loads between two limits. There are several values that need to be entered on this screen.

**Positive Rate** – This is the rate at which the load will be increased toward the **Upper Limit**. This value is entered in pounds per minute.

**Negative Rate** – This is the rate at which the load will be decreased toward the **Lower Limit**. This value is entered in pounds per minute.

**Dwell Time** – This is a “pause” at the upper and lower limits. It is entered in seconds.

**Upper Limit** – This is the load at which the test will stop increasing the load at the **Positive Rate**. It is entered as a value of pounds.

**Lower Limit** – This is the load at which the test will stop decreasing the load at the **Negative Rate**. It is entered as a value of pounds.

**Upper Increment** – This is a value that will increase the **Upper Limit** after each cycle. This can produce a cyclic test that increases the load with each successive cycle. The value is entered in pounds.

**Lower Increment** – This is a value that will increase the **Lower Limit** after each cycle. This can produce a cyclic test that increases the load with each successive cycle. The value is entered in pounds.

**Repeat Cycle** – This is the number of cycles desired for the test. The cycle counter is incremented after all four stages of a cycle are complete: positive ramp, dwell, negative ramp, and dwell. This value is entered as the number of time you want to cycle.

When you enter each value on this screen, press “Enter” on your keyboard to send the value to the PLC. You can also press the “Send Settings To Controller” button to verify that all the values have been sent to the PLC.



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You can also save your settings for future use. To do this, double-click the filename under the text, "Double-click to choose a recipe file to upload or save." A window will open allowing you to choose a name for your "Cyclic Test" file. You should give this file a unique name that you can remember if you want to restore the value (e.g., add the date to the end of the filename). All recipe files are stored in the same location. If you save this file with the same name as another file, you will overwrite the other file. You can create several different recipes for different situations, and load the desired recipe when needed.

### 9.3 **Segmented**

A segmented test allows you to specify different loads and rates during a test. You can enter up to ten (10) different segments for the test.

Upon entering the screen for the first time, only one segment is visible. You must now choose the control variable for this segment: **Time** or **Load**. Click corresponding button, and it will turn green. The other button will be gray.

Once a control variable is selected, the remaining fields for this segment will be available. If **Time** is selected, the **End Amount** will be a value entered in minutes. If **Load** is selected, you will need to enter a rate (in pounds per minute), and an **End Amount** (in Pounds). After entering the required fields, click **Set** to send the values to the PLC.

For control by **Load**, you can specify a positive or negative ramp. For a positive ramp, enter an **End Amount** that is larger than the previous **End Amount** (or larger than the preload value). For a negative ramp, enter an **End Amount** that is smaller than the previous **End Amount**.

As you enter values into each segment, the next segment will be available, up to ten (10) segments.

When you enter each value on this screen, press "Enter" on your keyboard to send the value to the PLC. You can also press the "Send Settings To Controller" button to verify that all the values have been sent to the PLC.

You can also save your settings for future use. To do this, double-click the filename under the text, "Double-click to choose a recipe file to upload or save." A window will open allowing you to choose a name for your "Cyclic Test" file. You should give this file a unique name that you can remember if you want to restore the value (e.g., add the date to the end of the filename). All recipe files are stored in the same location. If you save this file with the same name as another file, you will overwrite the other file. You can create several different recipes for different situations, and load the desired recipe when needed.

### 10 **Run Test**

Once the frame is calibrated, data and speeds values have been entered, and the test has been defined, the test can be run. Here is the test run procedure:



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1. Start the hydraulic pump motor by pressing the **Start** button on the control panel.
2. Choose the “Test Run” screen by clicking the **Test Run** button.
3. Push down the **Cycle Start** button.
4. Move the **Control** switch to the “Servo” position.
5. Pull up the Cycle Start button. This is a seal in process and steps 2-4 must be performed in this order to put the machine in ‘Auto’ mode.
6. Press **Start Test** to begin the test.

Since the machine needs to be open enough to load a new specimen into the machine, there is a gap between the specimen and the upper platen. In order to close this gap in a controlled manner, the machine must run in position control while closing the gap. The test, however, is run in pressure (or load) control. Therefore, a preload sequence is used. Preload advances the ram in position control at the **Preload Rate**. When the desired preload value is achieved, the machine switches to pressure (load) control, and the selected test begins.

Note: Some overshoot is normal. For example, if it was desired to control rate beginning at 50,000lbs, the operator should choose a value slightly lower (between 40,000 and 45,000lbs) to ensure the rate is under control at 50,000lbs.

The selected test will run until the specimen breaks, the desired number of cycles are complete, the desired segments are complete, or the operator stops the test.

### 11 Analysis

After a test is complete, the logged data can be viewed. Select the “Analysis” screen by clicking the **Analysis** button. This screen displays the logged data in graphic form, similar to the real-time trend on the “Test Run” screen.

If a test has not been run within the time range of the x-axis, the scroll buttons will need to be used to select the proper data file. The far-right button at the bottom of the trend will load the most recent data file.

The data files for each logged test reside on the hard drive of the HMI. They are located in the following directory: “D:\FORNEY\RSView\compression testing machine\DLGLOG\AnalysisData”.

There are two new files for each test. The files are “Database Four” file types, which have a “.DBF” extension. One of the files contains the tagnames that identify the logged signals in the HMI. The other file contains the data. The filename format is:

yyyy mm dd ##### AnalysisData (Wide).DBF

or

yyyy mm dd ##### AnalysisData (Tagname).DBF



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where:

yyyy – is the year the file was created

mm – is the month the file was created

dd – is the day the file was created

#### – is the consecutive number of file created on this date

Wide – is the data file

Tagname – is the tagname file

These files can be opened in Microsoft Excel, or in any text editor.





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### B) Accessories

The machine utilizes a set screw and holding stem system for easy installation and changing of accessories in the load frame. To change accessories, an operator loosens the set screw holding the accessory in the frame. **Care should be taken when doing this because once the set screw is loosened; the accessory will be free to fall!**

The quickest method to change accessories is to have a second person hold and remove the accessory while the operator loosens the set screw (**NOTE: Weight ranges from 10lbs to 50lbs or more for different accessories! Use caution when changing accessories!**) Another method if only one person is available, is to stack wood or another suitable material to brace the accessory while the set screw is loosened and then removing the bracing and accessory.

The machine is capable of testing many different specimen types. The setup shown below is the 6" x 12" cylinder. Please contact Forney for machine accessory inquiries.

